UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 25, 2002

MEMORANDUM TO: Melvyn N. Leach, Chief
Special Projects and Inspection Branch
Division of Fuel Cycle Safety
and Safeguards

THROUGH: Joseph G. Giitter, Chief
Special Projects Section
Special Projects and Inspection Branch, FCSS

FROM: Yawar H. Faraz
Senio: Project Manager
Special Projects Section
Special Projects and Inspection Branch, FCSS

SUBJECT: OCTOBER 8, 2002, MEETING SUMMARY: U.S. ENRICHMENT CORPORATION GAS CENTRIFUGE LEAD CASCADE PRE-APPLICATION MEETING ON INTEGRATED SAFETY ANALYSIS

On October 8, 2002, U.S. Nuclear Regulatory Commission (NRC) staff held a closed pre-application meeting with U.S. Enrichment Corporation (USEC) staff to discuss integrated safety analysis. I am attaching the meeting summary for your use. Although classified information was presented at the meeting, this summary contains no proprietary or classified information.

Docket: 70-7003

Attachment: USEC Gas Centrifuge Lead Cascade
Integrated Safety Analysis Meeting Summary

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OFC	SPIB*		SPIB*		SPIB	N		
NAME	YFaraz		KValloch		JGiitter			
DATE	10 / 23 /02		10 / 23 /02		10/25/02			

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U.S. Enrichment Corporation Lead Cascade Integrated
Safety Analysis Meeting Summary

Date: October 8, 2002

Place: U.S. Nuclear Regulatory Commission (NRC) Offices; Rockville, Maryland

Attendees: See Attachment 1

Purpose:

The purpose of this fourth pre-application meeting was to discuss with U.S. Enrichment Corporation (USEC), its plans for addressing integrated safety analysis (ISA) issues applicable to USEC's Portsmouth and Paducah gas centrifuge uranium enrichment test facility "lead cascade" license applications. The meeting, which lasted about three hours, was closed to members of the public and only individuals with "Q" clearances could attend since USEC's presentation included Secret Restricted Data. The discussion topic of USEC's previous (third) pre-application meeting with the NRC, which occurred on May 2, 2002, was also ISA. The May 2nd meeting was open to the public.

Discussion:

The lead cascade, which will consist of 240 centrifuges, is intended to provide USEC reliability data on the centrifuge machines and auxiliary systems. The lead cascade would recycle the enriched and depleted uranium it produces. The only uranium withdrawals from the cascade will be in the form of samples.

At the October 8th meeting, which lasted about three hours, USEC described its ISA methodology and provided some initial ISA results. USEC also informed the NRC that it would not be submitting its application for the lead cascade facility in December 2002 as previously anticipated but rather in early 2003. USEC is required by its memorandum of understanding with the Department of Energy (DOE) to submit its application before April 2003.

Following introduction of individuals attending the meeting, USEC staff provided a general review of its ISA methodology applied to the lead cascade. USEC staff had provided a more detailed discussion of its ISA methodology in the previous pre-application ISA meeting on May 2, 2002. The detailed May 2nd discussion had included a description of USEC's methodology for identifying and evaluating hazards and for determining potential consequences. This is documented in NRC's meeting summary dated May 21, 2002 (ML021430212). During the October 8th meeting, USEC also presented a detailed review of two sample cases including the bounding accident. These examples involved classified information. Following the presentation, USEC briefly described the contents of its ISA Summary document that it will submit to the NRC with its lead cascade license application.

During the meeting, USEC mentioned that it would strive towards being conservative in developing its ISA. USEC indicated that since it will not be selecting the Portsmouth or Paducah gaseous diffusion plant as the site for the lead cascade until after November 15, 2002,

it is preparing two separate lead cascade ISAs and applications; one for Portsmouth and one for Paducah. However, USEC will submit one application to the NRC for the site it selects after November 15, 2002. USEC indicated that the ISA for the lead cascade, which will be maintained at the site, contains a significant amount of classified information. However, USEC intends to prepare an unclassified ISA Summary which will be submitted to the NRC in early 2003 with the lead cascade application and will be available to the public for review.

Some of the other significant items discussed during the meeting are as follows:

1. Although USEC has not completed its ISA for the lead cascade, the most significant consequence that it has identified is from a chemical exposure of an individual to hydrogen fluoride at the "intermediate" consequence level as defined in Subpart H of 10 CFR Part 70. NRC staff indicated that in most cases for uranium, the environmental effluent concentration criterion contained in 10 CFR 70.61(c)(3) is more restrictive than the dose criterion for a member of the public contained in 10 CFR 70.61(c)(2). USEC indicated that it would reevaluate its accident sequences to ensure compliance with 10 CFR 70.61(c)(3).

2. USEC has assumed the member of the public to be located at the shortest distance to the Department of Energy (DOE) reservation boundary from the center of the lead cascade. USEC will apply conservative meteorology to estimate offsite impacts. The approximate distances between the maximally exposed member of the public and the center of the lead cascade is 800 meters and 1100 meters for Portsmouth and Paducah, respectively. As described in the two existing gaseous diffusion plant certificate application documents, USEC will describe in the lead cascade application, its arrangements for preventing adverse impacts from a accident sequence to members of the public who may be present in the area between the lead cascade fence line and the DOE reservation boundary at the time of an accident.

3. USEC indicated that the lead cascade will be designed to withstand a 1000-year return earthquake.

4. NRC staff indicated and USEC agreed that although a support system for an item relied on for safety (IROFS) may not be identified as an IROFS, the dependability of such a support system should be considered in determining the dependability of the associated IROFS. NRC staff also indicated the importance of considering the surveillance interval established for an IROFS in estimating the dependability of the IROFS and the likelihood of the associated mitigated accident sequence.

5. The NRC staff indicated that inclusion in the ISA Summary of one or two detailed examples illustrating the application of the ISA methodology would make NRC's review of USEC's application more efficient. This recommendation is also included in NUREG 1520.

6. USEC will consider uranium's toxicological effects on workers. USEC will also clearly delineate in the ISA, the IROFS boundaries, initial conditions and assumptions used in estimating accident sequence frequencies. As appropriate, USEC will support its probabilistic estimates with deterministic evaluations. USEC will comply with the baseline design criteria contained in 10 CFR 70.64(a).

USEC's presentation at the meeting included an unclassified and a classified handout. At the end of the meeting, USEC collected the classified handout which contained information pertaining to the two examples. USEC's unclassified handout is enclosed in Attachment 2.

NRC Action Items:

None.

Attachments: 1. Attendee list
2. Meeting handout

U.S. Enrichment Corporation Lead Cascade Facility
Pre-Application Meeting on Integrated Safety Analysis
Date: October 8, 2002

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Attachment 1

U.S. Enrichment Corporation Lead Cascade Facility
Pre-Application Meeting on Environmental Report
Date: October 9, 2002

NAME	AFFILIATION	PHONE	EMAIL ADDRESS
FREDERICK BURROWS	NMSS / FCSS	301-415-8110	FHB@NRC.GOV
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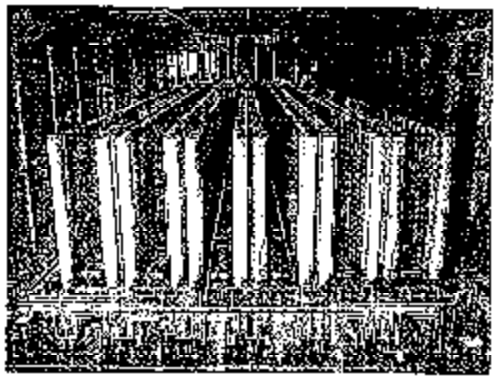


USEC/NRC 4th Pre-Application Meeting for the Centrifuge Lead Cascade Facility

NRC Headquarters

Rockville, Maryland

October 8, 2002

Attachment 2

AGENDA

- Purpose and Introduction
- Brief Review of Integrated Safety Analysis (ISA) Methodology
- Discussion of Sample Case ←
- Summary of Bounding Case ← CLASSIFIED
- Preparation of ISA Summary
- Conclusions
- Feedback and Action Plan

PURPOSE AND INTRODUCTION

- **In accordance with the DOE-USEC Agreement:**
  - ✓ A License Application for the Lead Cascade is scheduled to be submitted to the NRC by April 2003
  - ✓ The Lead Cascade will be sited at one of the Gaseous Diffusion Plant sites
- **Site selection activities are underway; both Paducah and Portsmouth are suitable**
- **The ISA Team has been prepared a draft ISA for each site**
- **Purpose of today's meeting is to:**
  - ✓ Summarize general content and preliminary results from the ISAs for the Lead Cascade to facilitate NRC review
  - ✓ Obtain NRC feedback to ensure the completed ISA meets expectations

PURPOSE AND INTRODUCTION

- **The preliminary results of the ISA indicate the following:**
  1. **There would be no off-site radiological impact from any of the potential accident scenarios**
  2. **The off-site chemical consequences of some of the potential accidents would be intermediate**
     - ✓ However, these events are either in the Unlikely or Highly Unlikely frequency range and therefore, acceptable
  3. **Mitigated consequences from potential accidents were determined to be acceptable based on:**
     - ✓ Small amount of inventory possessed during Lead Cascade operation
     - ✓ Distance between any postulated accident and the reservation boundary
     - ✓ Design features and management measures that will be in effect

HAZARD ANALYSIS DEVELOPMENT

- **Consists of two basic activities:**
  - ✓ Hazard Identification
  - ✓ Hazard Evaluation
- **Hazard Identification**
  - ✓ Systematic and comprehensive process designed to identify all known hazardous materials (radiological and chemical) and energy sources
  - ✓ Hazard Identification divided into three steps
    - – Division of facility into sections
    - – Facility walkdowns
    - – Screening for Standard Industrial Hazards

HAZARD EVALUATION (HE)

- Designed to ensure a comprehensive assessment of facility hazards and accidents
- Characterizes hazards by considering potential release mechanisms, identifying causes of the release, estimating initiating event frequency, and estimating consequences of the release
- Identifies risk and focuses attention on those events that pose unacceptable risk to the public and workers
- Identifies potential preventive & mitigating features
- Ultimately determines mitigated frequency and consequence level, and mitigated risk by applying Items Relied On for Safety
- HE scope includes: Process events, Natural phenomena, External events
- Consideration of the entire spectrum of possible events for a given hazard in terms of both frequency and consequence levels
- Hazards addressed by other programs and regulations (e.g., PSM, OSHA, RCRA, DOT, EPA) are considered only to the extent that loss of control of the hazard could result in a radiological or chemical release

HAZARD EVALUATION PROCESS

- **Divided into four major steps:**
  - ✓ Identification of Initial Conditions
  - ✓ Unmitigated Hazard Evaluation
  - ✓ Selection of Controls (IROFS), as required
  - ✓ Mitigated Hazard Evaluation

ASSUMPTIONS & INITIAL CONDITIONS

- **Used to establish an analysis reference baseline**
- **Specific conditions that are part of facility operations**
- **Used to clarify a point of analysis**
- **May include and inherently credit specific assumptions, inventory information, or specific passive design features**
- **Examples:**
  - ✓ On average, over 20 vehicle trips per day utilize the access road and pass the diesel generator fuel storage tank
  - ✓ Facility and process inventories are limited to a maximum specified inventory
  - ✓ Site access control limits the public from driving vehicles onsite

UNMITIGATED EVALUATION

- **Performed to determine risks involved with the facility and its associated operations without regard for safety controls or programs**
- **No credit is taken for preventive or mitigative features other than the specified Initial Conditions**
- **Unmitigated HE Table information includes:**
  - ✓ Event category and number
  - ✓ Postulated event description (including location, hazard source and mode of operation)
  - ✓ Causes
  - ✓ Unprevented frequency level
  - ✓ Unmitigated consequence level (onsite and offsite)
  - ✓ Unmitigated risk bin

UNMITIGATED EVENT FREQUENCY ESTIMATES
QUANTITATIVE DEFINITIONS OF LIKELIHOOD

- **Unmitigated event frequency estimates are largely qualitative, but may have semi-quantitative elements.**
- **Based on initial cause(s) of the event and any additional conditional probabilities that represent the progression of the event from the initiator to the point of a release**
- **Can be determined from engineering judgment or a variety of sources. Uncertainties accommodated by estimating in the conservative direction. Estimates are binned into the following Likelihood Levels**

Likelihood Level	Acronym	Frequency
Not Unlikely	NU	$f \geq 10^{-4}$/yr
Unlikely	U	$10^{-5} \leq f < 10^{-4}$/yr
Highly Unlikely	HU	$10^{-6} \leq f < 10^{-5}$/yr

Credible is as defined by NUREG-1520 and generally implies a frequency $\geq 10^{-6}$/yr

UNMITIGATED CONSEQUENCE LEVEL

- **Dose or exposure at specified receptor locations based on unmitigated release of hazardous material**
- **Function of**
  - ✓ Type and characteristics of the hazard
  - ✓ Quantity of hazardous material released
  - ✓ Release mechanism
  - ✓ Relative location of the release
  - ✓ Relevant transport characteristics
- **Evaluated at three receptor locations**
  - ✓ Public - Everyone outside Controlled Area (same as GDP Reservation Boundary)
  - ✓ Worker -Controlled Area - Individuals outside the occupied area of the hazard (outside the Restricted Area) but within the boundary of the Controlled Area
  - ✓ Worker - Restricted Area - Individuals immediately adjacent to, or in, the occupied area of the hazard (i.e., within the Restricted Area)

RADIOLOGICAL RELEASE CONSEQUENCES

- **Qualitative or semi-quantitative assessment, based on the "source term" for the event, i.e., amount of hazardous material that is assumed to be released and subsequently becomes airborne**

Radiological Consequence Levels for Evaluated Receptors

Consequence Level (Abbreviation) ↓	Public (Outside Controlled Area)	Worker-CA (Outside Restricted Area, Inside Controlled Area)	Worker - RA (Inside Restricted Area)
High (H)	Acute Dose ≥ 25.0 rem TEDE	Acute Dose ≥ 100.0 rem TEDE	Acute Dose ≥ 100 Rem TEDE
Intermediate (I)	5.0 ≤ Acute Dose < 25.0 rem TEDE, or release of material released over a 24 hr period which exceeds 1.5E-6 uCi/ml, but is < 1.5E-3 uCi/ml in water	25.0 ≤ Acute Dose < 100.0 rem TEDE, or release of material released over a 24 hour period which exceeds 5E-6 uCi/ml in river 1.5E-3 uCi/ml in water	25.0 ≤ Acute Dose < 100.0 rem TEDE
Low (L)	Acute Dose < 5.0 rem TEDE	Acute Dose < 25.0 rem TEDE	Acute Dose < 25.0 rem TEDE

CHEMICAL CONSEQUENCE LEVEL

Chemical Consequence Levels for Evaluated Receptors

Consequence Level (Abbreviation) ↓	Public (Outside Controlled Area)	Worker-CA (Outside Restricted Area, Inside Controlled Area)	Worker - RA (Inside Restricted Area)
High (H)	Acute exposure, C ≥ ERPG-2, or intake of ≥ 30 mg of uranium in soluble form, or which could lead to irreversible or serious long-lasting health effects	Acute exposure, C ≥ ERPG-3, or which could endanger the life of the worker	Acute exposure, C > ERPG-3, or which could endanger the life of the worker
Intermediate (I)	Acute exposure, ERPG-1 < C < ERPG-2, or which could cause mild transient health effects	Acute exposure, ERPG-2 ≤ C < ERPG-3, or which could lead to irreversible or serious long-lasting health effects	Acute exposure, ERPG-2 < C < ERPG-3, or which could lead to irreversible or serious long-lasting health effects
Low (L)	Acute exposure, C < ERPG-1	Acute exposure, C < ERPG-2, or which could cause mild transient health effects	Acute exposure, C < ERPG-2, or which could cause mild transient health effects

RISK BINNING MATRIX, PUBLIC

Risk Binning Matrix, Public (Offsite, Outside Controlled Area)

Frequency → / Consequence ↓	Highly Unlikely	Unlikely	Not Unlikely
High	II		
Intermediate	II	II	
Low	II	II	II

Region A

Unmitigated events falling in Region A require preventive or mitigative controls (IROCS). The desired result is that the mitigated combination of consequence and frequency is moved into the B region.

Region B

Unmitigated events with risk falling in Region B generally have negligible risk and no further action is required. However, the facility may decide to add additional controls for these events based on management decision.

RISK BINNING MATRIX, WORKER-CA

Risk Binning Matrix, Worker–CA (Outside Restricted Area, Inside Controlled Area)

Frequency -> / Consequence ↓	Highly Unlikely	Unlikely	Not Unlikely
High Acute Dose [illegible] TEDE, Acute chemical exposure, [illegible], or other events endanger the life of the worker	B	[illegible]	[illegible]
Intermediate 25 [illegible] Acute Dose [illegible] TEDE, or average radiological material [illegible] over a 24 hour period which exceeds [illegible] or 1 [illegible] release to water, or acute chemical exposure, [illegible] which could lead to irreversible or serious long-lasting health effects	B	B	[illegible]
Low Acute Dose [illegible] TEDE, or acute chemical exposure, [illegible], or which could cause mild transient health effects	B	B	B

Region A

Unmitigated events falling in Region A require preventive or mitigative controls (IROFS). The desired result is that the mitigated combination of consequence and frequency is moved into the B region.

Region B

Unmitigated events with risk falling in Region B generally have negligible risk and no further action is required. However, the facility may decide to add additional controls for these events based on management decision

Risk Binning Matrix, Worker-RA

Risk Binning Matrix, Worker–RA (Inside Restricted Area)

Frequency → / Consequence ↓	Highly Unlikely $10^{-4} \le f < 10^{-3}$/yr	Unlikely $10^{-3} \le f < 10^{-2}$/yr	Not Unlikely $f \ge 10^{-2}$/yr
High Acute Dose ≥ 100.0 rem TEDE, or Acute chemical exposure, ≥ ERPG-3, or which could endanger the life of the worker	B	[redacted]	[redacted]
Intermediate 25.0 ≤ Acute Dose < 100.0 rem TEDE, or acute chemical exposure, ERPG-2 ≤ C < ERPG-3, or which could lead to irreversible or serious long lasting health effects	B	B	[redacted]
Low Acute Dose < 25.0 rem TEDE, or acute chemical exposure, C < ERPG-2, or which could cause mild transient health effects	B	B	B

[redacted]

Region A

Unmitigated events falling in Region A require preventive or mitigative controls (ITROPS). The desired result is that the mitigated combination of consequence and frequency is moved into the B region.

B

Region B

Unmitigated events with risk falling in Region B generally have negligible risk and no further action is required. However, the facility may decide to add additional controls for these events based on management decision.

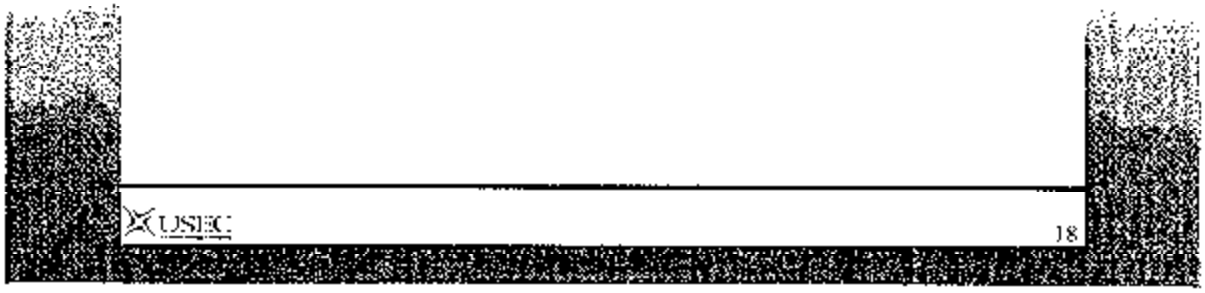
VALUE OF PREVENTIVE AND MITIGATIVE IROFS

- **Initial Preventive Values (Frequency Reduction):**
  - ✓ Administrative Control 10^{-1}
  - ✓ Active Design Control 10^{-2}
  - ✓ Passive Design Control 10^{-3}
  - ✓ Values are modified as necessary on a case-by-case basis, based on the nature of the event and the strength of the control

- **Initial Mitigative Values of IROFS (Consequence Reduction):**
  - ✓ Evacuation (Worker RA) 1/100
  - ✓ Alert & Notification - Shelter or Evacuation (Worker CA) 1/100
  - ✓ Alert & Notification - Shelter or Evacuation (Public) 1/10
  - ✓ Values are modified as necessary on a case by case basis, based on the nature of the release event

SAMPLE CASE AND BOUNDING CASE
(CLASSIFIED Handouts)

- **Sample Case**
  - ✓ Explosion/Deflagration of Diesel Fuel Storage Tank
- **Bounding Case**
  - ✓ Large Fire in Process Building



HAZARD ANALYSIS SUMMARY

- Hazard identification involves a systematic and comprehensive process designed to identify all known hazards
- The hazard evaluation process is designed to ensure a comprehensive assessment of facility hazards and accidents
- The technique identifies risk and focuses attention on those events that pose unacceptable risk to the public and workers
- The purpose of the unmitigated/mitigated approach is to demonstrate that the selected preventive and mitigating IROFS reduce the event risk to a level that meet the 10 CFR 70.61 performance requirements

PREPARATION OF ISA SUMMARY

- **ISA Summary being prepared based on results of ISA**
- **NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*, being used as guidance**
- **The contents of the ISA Summary are specified in 10 CFR 70.65 and include the following nine topics:**
  - ✓ General description of the site
  - ✓ General description of the facility
  - ✓ Description of facility processes, hazards, and types of accident sequences
  - ✓ Demonstration of compliance with 10 CFR 70.61 performance requirements
  - ✓ Description of the ISA team qualifications and ISA methods
  - ✓ Descriptive list of IROFS
  - ✓ Description of acute chemical exposure standards used
  - ✓ Descriptive list of sole IROFS
  - ✓ Definition of the terms "credible," "unlikely," and "highly unlikely"

CONCLUSIONS, FEEDBACK, ACTION PLAN

- Site selection for the Lead Cascade will be completed later this year
- USEC plans to submit the ISA Summary in support of the Lead Cascade License Application by early next year
- Based on the results from the draft, consequences of mitigated accident scenarios are acceptable
- USEC is prepared to support NRC site visits and meetings to discuss the ISA and ISA Summary and is receptive to any other ways to facilitate the review